



ORCHID CELLMARK

A Leader in Identity DNA Testing Services

An Introduction to Y-STR Testing

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Orchid Cellmark

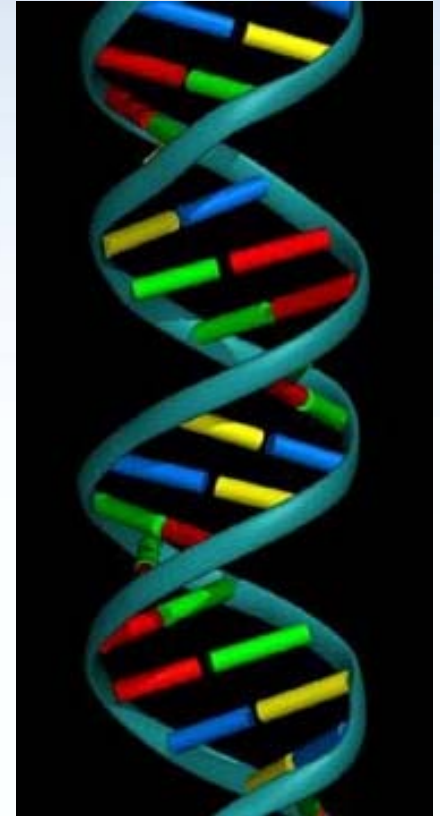
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Y-STR and Mitochondrial DNA Analysis

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What is DNA?

- ◆ DNA = deoxyribonucleic acid
- ◆ DNA is the instruction manual for your body – it makes us who we are
- ◆ Inherit $\frac{1}{2}$ of DNA from your dad and $\frac{1}{2}$ of DNA from your mom
- ◆ Everyone has a unique DNA profile, with the exception of identical twins!




DNA is found throughout your entire body

- ◆ Blood
- ◆ Semen
- ◆ Saliva
- ◆ Urine
- ◆ Hair
- ◆ Teeth
- ◆ Bone
- ◆ Tissue
- ◆ Skin



What Can be Tested?

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- ◆ Essentially any item of evidence with biological material can be tested for DNA
 - ❖ Sexual assault swabs
 - ❖ Fingernails
 - ❖ Clothing
 - ❖ Hairs
 - ❖ Items that have been touched or handled (ex: weapons such as guns, knives, etc.)
 - ❖ Ligatures used for strangulation
 - ❖ Stains collected from an object or surface
 - ❖ ... the list goes on and on

3 Primary Types of DNA Testing

◆ STRs:

- ❖ Widespread acceptance in the forensic community
- ❖ Used in labs across the US and internationally
- ❖ Virginia Department of Forensic Sciences

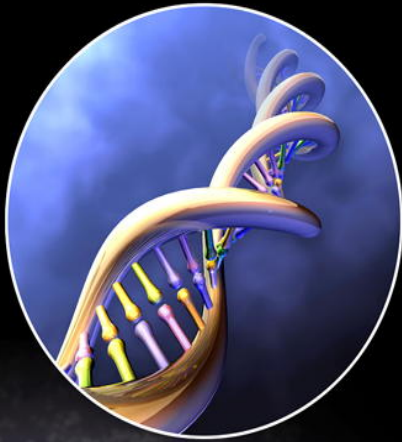
◆ Mitochondrial DNA:

- ❖ Specialized DNA test: widespread acceptance in the forensic community
- ❖ Used in labs in the US and internationally
- ❖ Virginia Department of Forensic Sciences

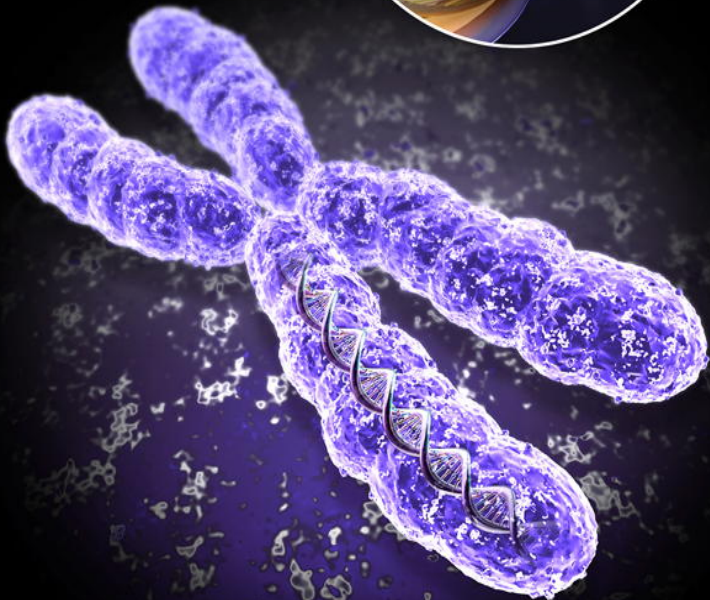
◆ Y-STRs:

- ❖ Specialized DNA test: widespread acceptance in the forensic community
- ❖ Used in labs across the US and internationally
- ❖ Currently not used by the Virginia Department of Forensic Sciences

What is STR Testing?

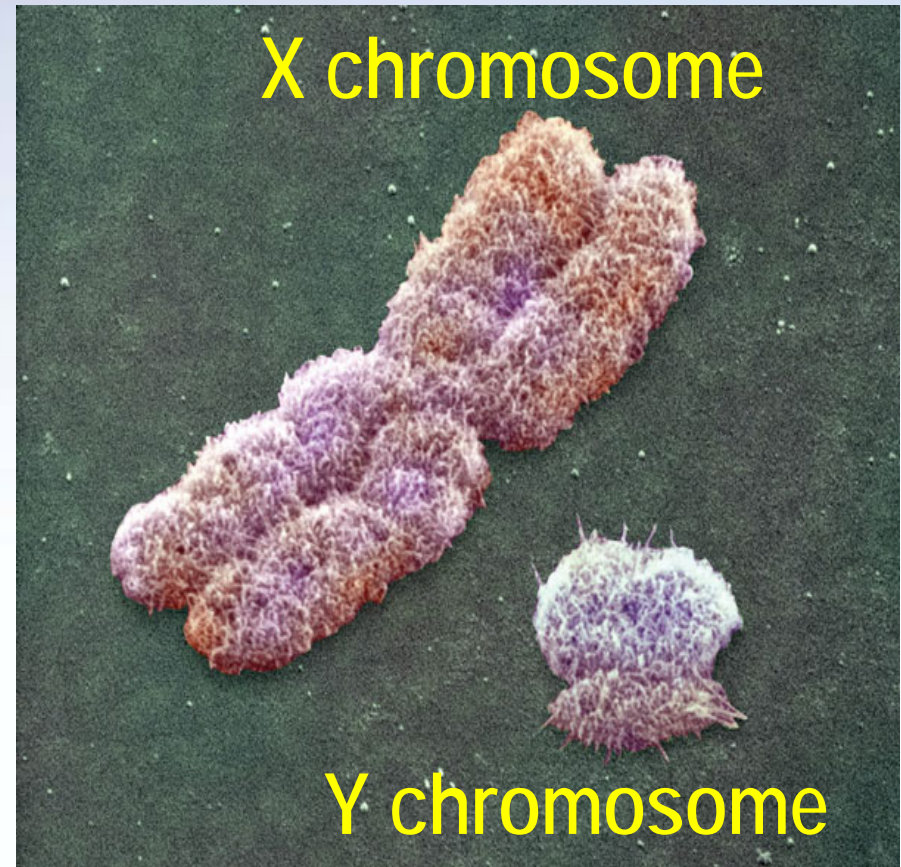


- ◆ Type of testing performed in crime labs
- ◆ Examines female and male DNA
- ◆ Look at 13 different areas of the DNA (on multiple chromosomes) to develop an STR profile
- ◆ Can pinpoint 1 person in the world (except identical twins)



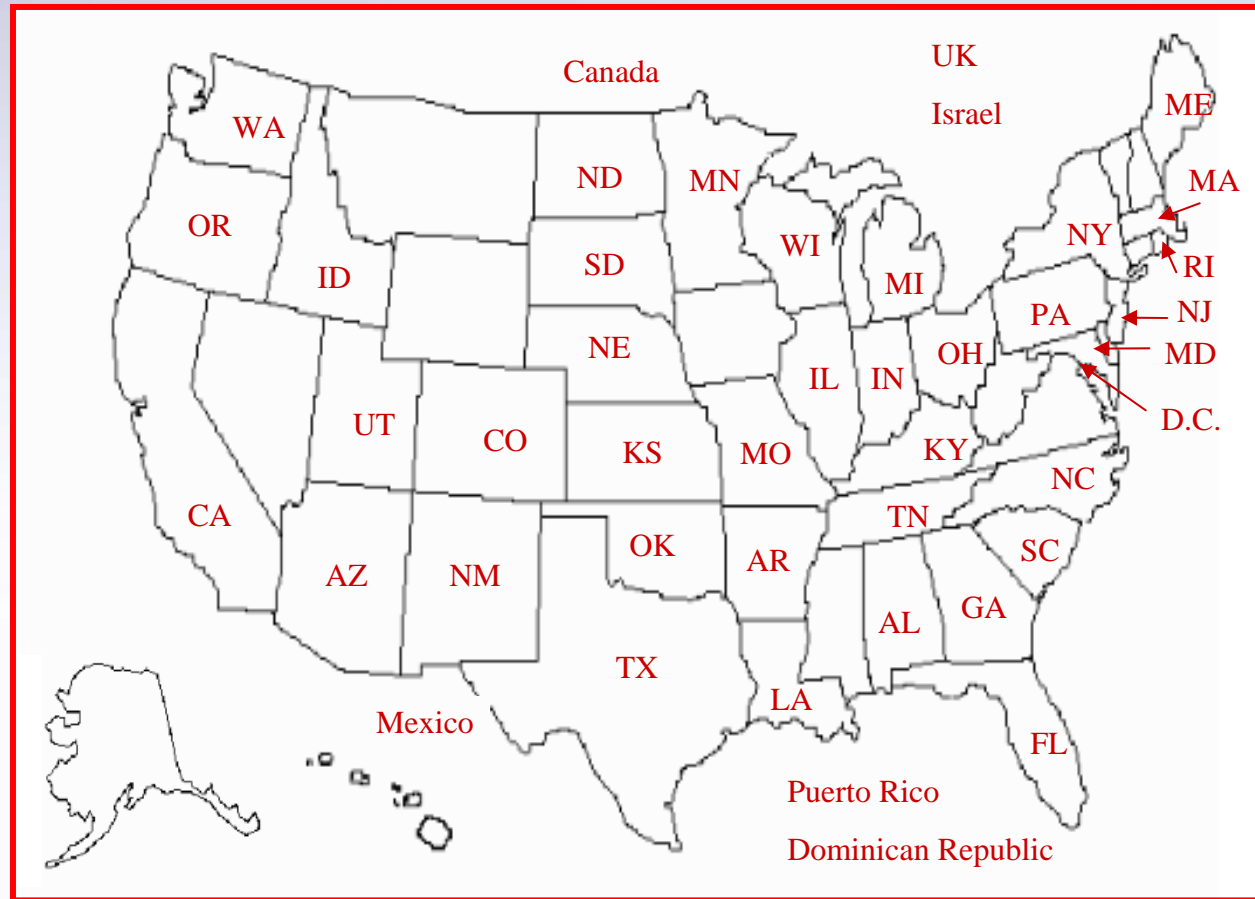
What is Y-STR Testing?

- ◆ Methods used are very similar to those used in STR testing
- ◆ However, Y-STRs only examine **MALE DNA**
- ◆ Ignores female DNA
- ◆ Look at 17 areas of the Y chromosome to develop a Y-STR profile



Y-STR Testing at Orchid Cellmark

- ◆ Began Y-STR testing in 2002
- ◆ Y-STR testing in >500 cases, US and abroad



Y-STR Testing at Orchid Cellmark

- ◆ Y-STR testimony provided >20 times
 - ❖ Texas, Oklahoma, Michigan, Massachusetts, Colorado, Ohio, Kentucky, California, Florida, New Mexico, Indiana
 - ❖ ~ 5 admissibility hearings: all successful
- ◆ Use commercially available Y-STR kits → more standardization between laboratories

Advantages and Limitations of Y-STR Testing

- ◆ Y-STR testing **cannot uniquely identify** an individual
 - ❖ Men get their Y chromosome directly from their fathers
 - ❖ All men from the same lineage will have the same Y-STR profile
- ◆ Statistics: less discriminating than conventional STRs
 - ❖ Perhaps 1 in ~3500 (this will soon be 1 in ~14,000)
 - ❖ Powerful in their ability to exclude a suspect
 - ❖ Cannot search for a Y-STR profile in CODIS, the convicted offender database
- ◆ Male specific DNA test!

When should Y-STR testing be used?

- ◆ Majority of cases:
 - ❖ Y-STRs are used after more conventional DNA testing (STR) is attempted or if screening indicates little male DNA is present
- ◆ Minority of cases:
 - ❖ Y-STR testing may be the 1st type of testing used
- ◆ Substantially larger amount of female than male DNA (high ratio of female:male)
- ◆ Very small amounts of male DNA

Y-STR Testing May be Useful in Sexual Assault Cases

- ◆ Large amounts of female DNA and small amounts of male DNA (ex: sexual assault swabs)
 - ❖ Sometimes the male DNA hides behind the female's profile
 - ❖ Male DNA is completely obscured or difficult to interpret
- ◆ No or few sperm cells
 - ❖ Includes seminal fluid from vasectomized males
 - ❖ Male DNA can be detected from epithelial cells in ejaculate, even if sperm are not present
- ◆ Male saliva collected from female's body
 - ❖ Example: only oral contact is reported by the victim

Y-STR Testing May be Useful in Homicide Cases

- ◆ Mixture of male and female blood
 - ❖ Example: suspect allegedly cuts himself while stabbing a female victim
- ◆ Fingernail clippings from a female victim
 - ❖ Often a large amount of female DNA
- ◆ Ligatures used for strangulation – contact DNA from male
- ◆ In most of these examples, the amount of female DNA may overwhelm the male DNA.
- ◆ In most of these examples, STRs are attempted 1st
 - ❖ Y-STRs are often used as a second step in the DNA testing process

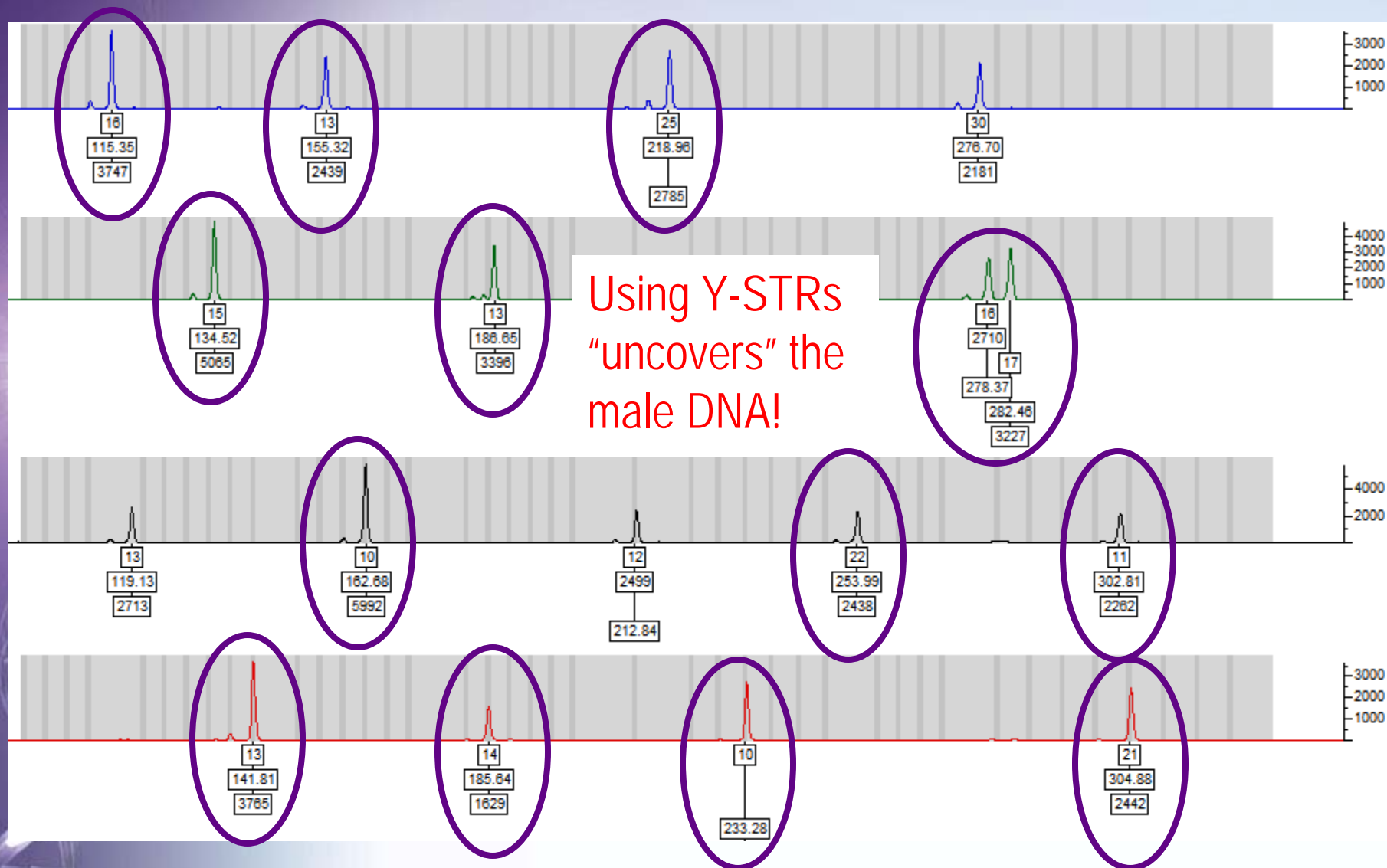
Y-STR Testing at Orchid Cellmark

- ◆ Of the total casework: only ~5-10% is Y-STR testing
- ◆ Of the Y-STR casework: only 10-15% is at the request of the defense (including post-conviction)
- ◆ What does this mean?
 - ❖ For every 100 DNA cases, ≤ 1 case is post-conviction Y-STR testing

Case Example #1: Panty cutting

- ◆ Previous STR testing performed at state crime lab
- ◆ Only detected female DNA from the panty cutting
 - ❖ Classic Y-STR case: female DNA obscures the DNA profile from the male contributor (ratio of female:male is too high!)

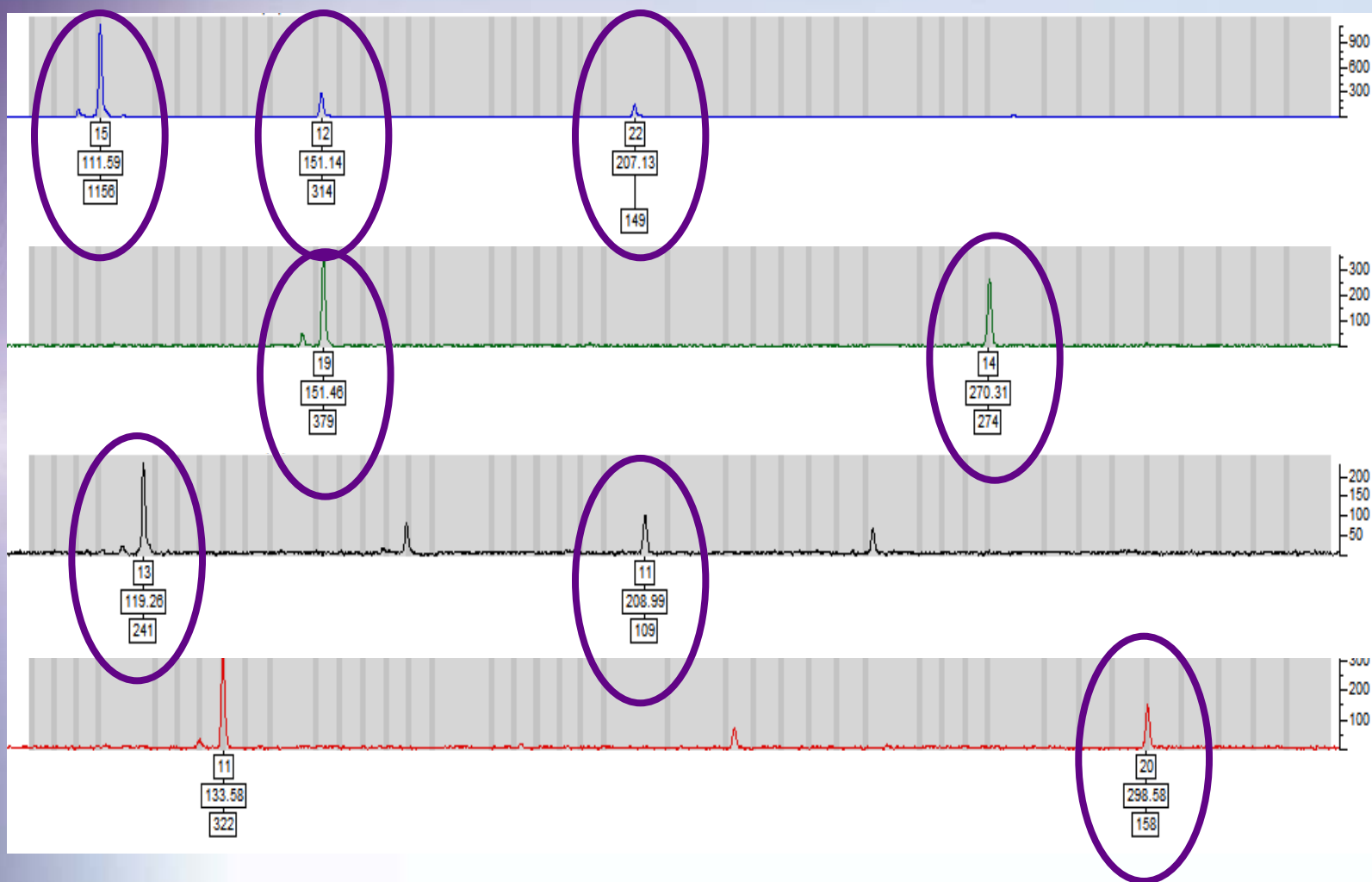
Case Example #1: Panty cutting



Case Example #2: Vaginal smear sample

- ◆ Limited male DNA present on a challenging sample
- ◆ Possible degradation of DNA

Case Example #2: Vaginal smear sample



These are only 2 examples of exonerations based on Y-STRs – there have been multiple others!

Things to Keep in Mind...

- ◆ If you can get STR DNA testing results, do it!
 - ❖ STRs are highly discriminating and detect both female and male DNA!
 - ❖ STR results are uploadable into the CODIS database, Y-STRs aren't!
 - ❖ Y-testing should typically be reserved for cases when STR testing fails or is inconclusive
- ◆ Y-STR testing cannot uniquely identify an individual
 - ❖ All men from the same male lineage have the same Y-profile
- ◆ Y-STR testing can provide extremely valuable genetic information when other testing has failed, is inconclusive, or not appropriate based on the case/sample type

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